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Application of ERTS and EREP Images to Geologic Investigations of  
the Basin and Range - Colorado Plateau Boundary in Northwestern  
and North-Central Arizona. #308 GSFC No. PR522

Type I Progress Report  
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15 August 1972 - 15 October 1972

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Problems:

A major problem hindering our direct use of the NDPF supplied photographic material is the density of the MSS 70 mm negatives. To date we have received four image sets and in each case the average density of the negatives was approximately 2.3 with a variation over the image of  $\Delta D \approx \pm 0.2$ . It is not possible to enlarge such scenes to the required 1:250,000 scale with standard photolab equipment. We attempted the required 1/2 hour exposure but terminated it after five minutes for fear of damaging the enlarger.

NDPF must provide fourth generation negatives that are of some value to the user. At the present time they have no value whatsoever. Since the fourth generation negatives are not used in producing further products in the NDPF facility, they do not need to conform to density values established for earlier generations. Therefore it is suggested that NDPF print the negatives so that the densities fall within the 0.5 to 1.5 range. Exact radiometric traceability is not a requirement for the enlarged products, therefore some non-linearities are acceptable.

The Ames-provided 70 mm U-2 overflight material was disappointing in quality. Although the flight was made on August 9, we have not yet received metric camera color photography.

(E72-10157) APPLICATION OF ERTS AND EREP  
IMAGES TO GEOLOGICAL INVESTIGATIONS OF THE  
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IN A.F.H. Goetz (Jet Propulsion Lab.)  
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Accomplishments and Plans:

Computer Image Processing

The MSS test tapes were successfully run and programs have been written to format the data for compatibility with IPL VICAR analysis programs. An ERTS-1 image tape has not yet been received for analysis.

Shivwits Plateau

Most of the preliminary work has been done to set up and initiate the field work phase of the project. Specifically, topographic maps have been obtained, pertinent references have been assembled and read, topical maps of regional coverage have been prepared to show gross distribution of rock units critical to the study, and finally field equipment necessary for the work has been assembled or is being processed. In addition, contact has been established with government agencies and private individuals who have interests in the areas to be mapped.

About ten days have been spent in the field. The planned stay was longer, but was terminated by mechanical breakdown of our field vehicle. Nevertheless, a good start has been made on producing a control map of the area: about four 7-1/2' quadrangles have been mapped, a section has been measured in the units that are exposed on much of the surface of the Shivwits Plateau, the pertinent stratigraphic units have been examined, and numerous samples have been collected. In addition, a strategy of mapping has been developed which will enable us to cover the area in a reasonably efficient way. Because parts of the area are so remote as to be inaccessible on foot or even by helicopter -- were one available -- arrangements are being made for flying over these areas in a light aircraft, for the purpose not only of obtaining a general overview, but also of covering the critical spots by oblique photography and

carrying out as much mapping from the air as time will allow. The geology of the Shivwits Plateau lends itself to this approach which, indeed, seems to be the only one available.

Our work so far has been hampered seriously by the lack of ERTS and aircraft underflight photography, which has put us in the somewhat extraordinary position of mapping on 7-1/2' topographic maps for a project that pertains to Earth-orbiting satellites. This should be rectified soon, and a start has been made by the recent acquisition of U-2 underflight photography for part of the area.

#### Cataract Creek

Images 1013-17373-5 and 1032-17373-5 have been analyzed visually on a 1:1,000,000 scale. The pictures show good photometric contrast among major geologic units of interest. Good contrast is also present within certain units (e.g., Kaibab) which was not previously anticipated and which will allow subdivision and mapping of individual members.

Previously unmapped large and small faults and folds are well displayed and can be mapped directly from the photographs. Recent volcanic units just east of Cataract Creek basin, by inspection of the photos, appear to be strongly absorbing in band 7. Computer image processing should be useful in discriminating among these units.

In one area near the center of Cataract Creek Basin a pronounced local change in contrast was observed between August 6 and August 24. The cause of this change is being investigated.

Preliminary study of the pictures shows that they are extremely well suited for the regional geologic mapping planned.

Central Arizona

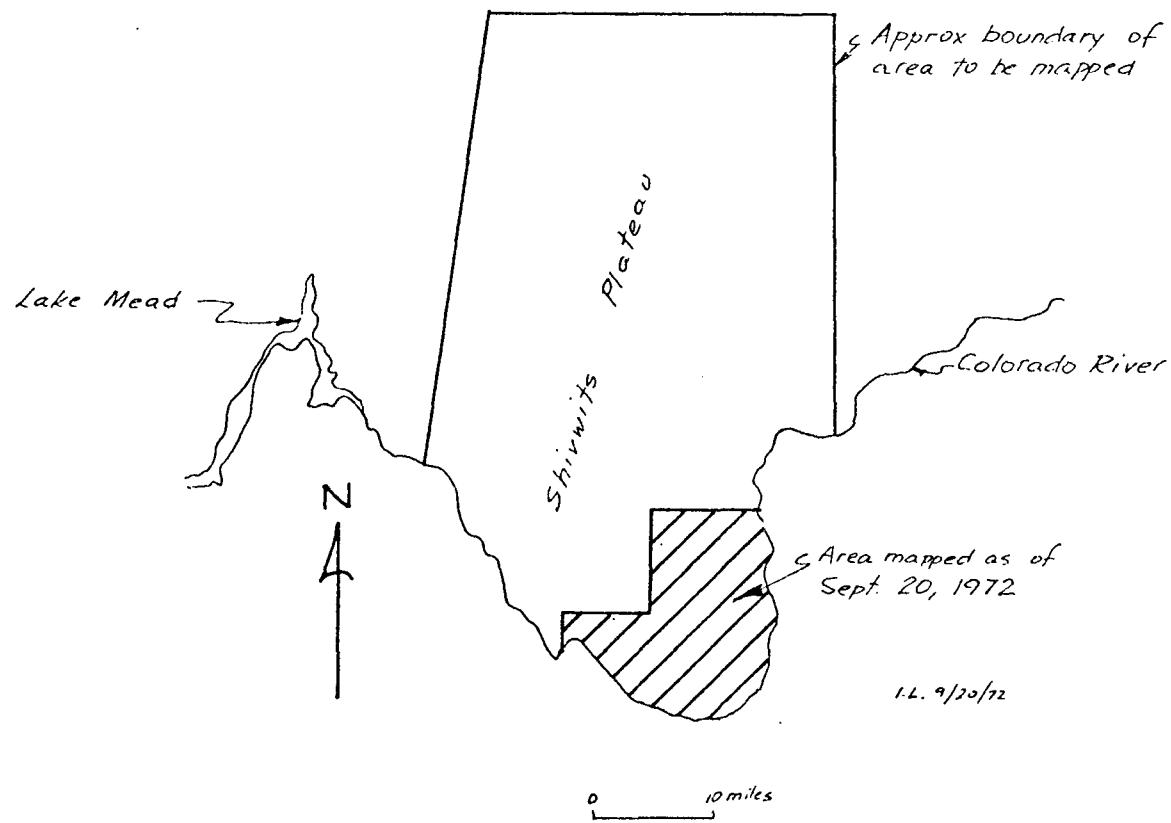
The ERTS E-1013-17321 MSS image of Central Arizona has been reviewed for synoptic geologic information in and near Area D. ERTS A/C support photography of Area D, numbers 46-81, flight 72-136, August 9, 1972, also have been subjected to a preliminary review.

Pliocene(?) - Pleistocene lake beds of the Verde Formation, which appear light, stand in sharp contrast with adjacent dark basaltic rocks of the Mogollon Rim and Black Hills. Areas containing calcium and sodium sulfates are among the highest reflective spots in the Verde Formation.

Rocks of the Verde Valley volcanic center, partially obscured by clouds, display a faint structural pattern related to a series of tuffs interbedded in the upper half of the thick, dominantly basaltic section of rocks.

Various structural lineations are seen in different parts of the study area. Along the Mogollon Rim, near and west of Sedona, northwest-trending, north-trending, and a few prominent east-west-trending lineaments appear to be newly recognized. South of the Verde Valley volcanic center, well developed northeast-trending lineaments reflect the exposure of Precambrian basement rocks.

In the next reporting period, providing we can obtain tapes, the full gambit of IPL image processing programs will be applied to pictures of these areas. Extensive field checking will be made with the portable field reflectance spectrometer nearing completion. Field mapping based on the ERTS and U-2 photography will continue.



Map showing area mapped as of September 20, 1972